

Hands-on numbers

For many years I have been advocating the use of hands-on materials to assist students in the understanding and application of mathematical concepts. Some of the methods have been introduced as small parts of earlier *Discovery* articles, (de Mestre, 1994, 1996, 1998, 1999a, 1999b, 1999c, 2000a, 2000b, 2001), but here I propose to devote the whole article to the development of hands-on tasks involving number operations specifically.

The hands-on task material can be easily constructed, and this may involve other sections of your school such as the art department or manual arts department or even the local parents' association. Here are some basic number tasks.

Task 1: Addition totals

The equipment needed is seventeen discs which are numbered 0 to 16.

1. Find two discs that add to a total of 11.
2. Can you find any other pairs that also add to 11?
3. How many pairs altogether can add to 11?
4. How do you know that you have found them all?
5. What if the total was 12? Now how many pairs can you find?
6. What if the total was 13?
7. Can you predict how many pairs there would be if the total was 25? or 99?
8. If the number of discs was changed to $N + 1$ and numbered successively from 0 to N , how many pairs would there be for a total of K (any positive integer)?

Task 2: Domino squares

The equipment needed is a set of dominoes and a frame that takes four dominoes. The frame is made from three wooden pieces as shown in Figure 1, glued together to form a square path which is 1.5 dominoes along each side.

A domino square is one in which the sum of the numbers along each side is the same.

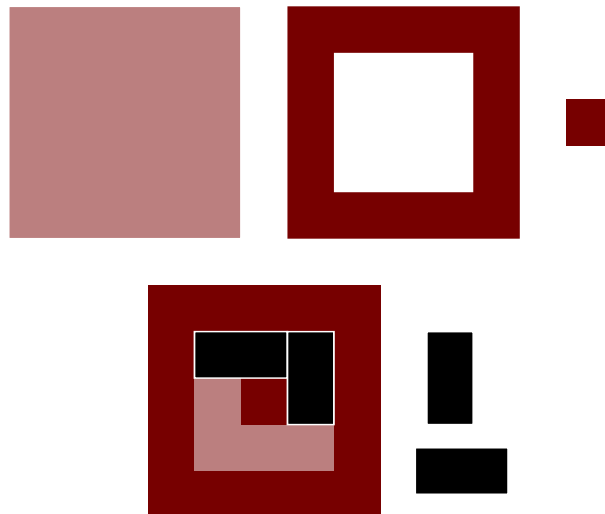


Figure 1

1. Use the 5/3 and 6/2 dominoes to find two other dominoes to complete the domino square.
2. Find the domino square with the largest possible total.
3. Find the domino square with the smallest possible total.
4. Create a different domino-square task.

Task 3: Around the boundaries

The equipment needed is a chart and 8 discs numbered 21 through to 28. The chart can be constructed from a masonite board (60 cm \times 45 cm is a good size) painted as shown in Figure 2.

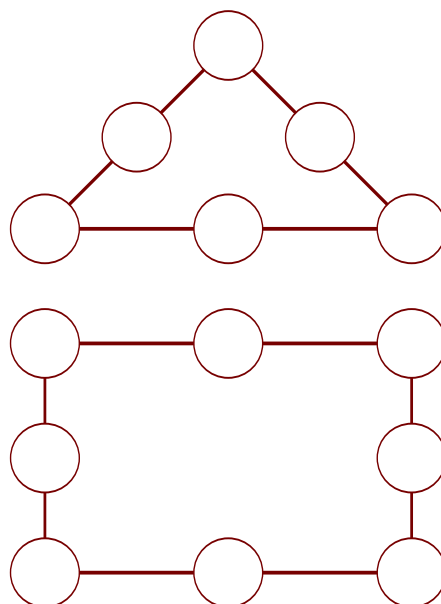


Figure 2

1. Place the discs 21 to 26 on the circular spaces on the triangle so that the numbers on each side of the triangle add up to 69.
2. Next, make them add up to 70, then 71, then 72.
3. What other totals are possible?
4. Place the discs 21 to 28 on the circular spaces on the square so that the numbers on each side of the square add up to 72.
5. Next, make them add up to 73.
6. What other totals are possible?

Task 4: Uranium pile

The equipment is a square block with nine [9] holes drilled partly through it in a 3×3 array (Figure 3), and nine [9] cylindrical rods that just fit individually into each hole. The rods are numbered respectively 3, 6, 7, 9, 10, 11, 13, 14, 17 on their ends.

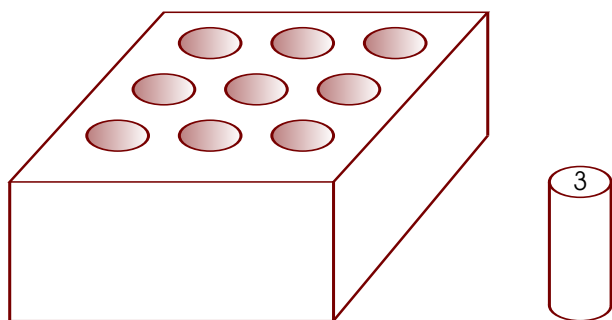


Figure 3

Active uranium rods are carried in a lead box to prevent radioactivity escaping.

The rods are to be placed in the holes in the box.

Each rod has its radioactive strength written on it.

The level of radioactivity is dangerous if the total strength along any row, column or diagonal exceeds 30.

Make the box safe with the rods stored in it.

Task centres

These four tasks are just the tip of the 700 hands-on tasks that have been developed over the past 30 years here in Australia at two main educational institutions. One lot of tasks was created at the ACT Mathematics Centre from 1976 to 1991 and are now incorporated in the Questacon Science and Technology Centre's Outreach Program (www.questacon.edu.au/html/questacon_maths_centre.html).

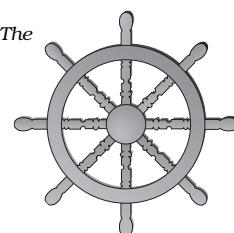
The other group of tasks has been developed through the Curriculum Corporation by Charles Lovett and Doug Williams (www.blackdouglas.com.au/taskcentre). You can purchase ready made tasks through the latter, or you can make your own for class purposes from the ideas in two books (de Mestre, 1993; de Mestre & Richards, 1991).

The wonderful hands-on mathematical experiences available to school children through these tasks are enriched by the students working in pairs on each task for maximum educational and communication growth. They should be encouraged to share ideas, to work as a team, and to jointly feel the elation of solving the task problem.

Future *Discovery* articles will consider a selection of shape or geometrical tasks, measurement tasks and mathematical tasks based on logic, as well as ideas to help you develop a simple task into a whole lesson or extension for projects and assignments.

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